Six marine macroalgal genera new to South Africa

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Research on the benthic marine algal flora of Natal has contributed many records of taxa new to South Africa. Four of the six genera new to this region reported here, *Asparagopsis, Dudresnaya, Titanophora* and *Eucheuma*, belong in the Rhodophyta, and the remaining two, *Boergesenia* and *Trichosolen*, to the Chlorophyta. The gametophyte of *Asparagopsis taxiformis* is reported for the first time in South Africa, and the tetrasporophyte of *Dudresnaya hawaiiensis*, which has not been seen before, is described. Two species of *Eucheuma, E.* cf. *odontophorum* and *E.* cf. *denticulatum*, are reported. *Titanophora pikeana* is identified from Natal specimens, all gametophytes, and new data are provided on its reproduction and structure, which, for the first time, is demonstrated to be uniaxial.

Navorsing op die bentiese marine-algflora van Natal het heelwat bygedra tot die beskrywing van nuwe Suid-Afrikaanse taksa. Vier van die ses genera wat nuut is vir die streek en hier beskryf word, nl. *Asparagopsis, Dudresnaya, Titanophora* en *Eucheuma*, behoort tot die Rhodophyta, en die oorblywende twee, *Boergesenia* en *Trichosolen*, tot die Chlorophyta. Die gametofiet van *Asparagopsis taxiformis* word vir die eerste keer in Suid-Afrika gerapporteer, en die tetrasporofiet van *Dudresnaya hawaiiensis*, wat nog nooit vantevore waargeneem is nie, word beskryf. Twee spesies van *Eucheuma, E.* cf. *odontophorum* en *E.* cf. *denticulatum*, word beskryf. *Titanophora pikeana* is van Natalse eksemplare, almal gametofiete, geïdentifiseer, en nuwe data word verskaf van die voortplanting en die struktuur, wat vir die eerste keer as uni-aksiaal beskryf word.

Keywords: Chlorophyta, Indian Ocean, macroalgae, Rhodophyta, South Africa.

Introduction

The macroalgal flora of South Africa is known to have a large number of species, and a recently published list of species from this region (Seagrief 1984) provides a summary of this impressive benthic algal flora. Certain parts of South Africa, especially Natal, have had only superficial investigations on the algal flora until recent times, but our studies have revealed numerous taxa new to this region (Norris & Aken 1985; Gordon-Mills & Norris 1986; Norris 1986a,b, 1987a–e, 1988a,b). Most of the newly reported taxa were previously known only from regions remote to South Africa. The present report continues the series of papers on Natal seaweeds, providing data on six genera new to South Africa. Some of these genera are relatively rare and poorly described, and new information on their structure and reproduction is provided.

Materials and Methods

Specimens were collected and preserved in the field in approximately 5% formalin in sea-water. The specimens were sorted in the laboratory where microscope slides were prepared, pieces of thalli maintained in formalin for future study and, if enough material was available, herbarium sheets of dried specimens were prepared. Specimens on slides were mounted in corn syrup to which 1% aniline blue was added with HCl acidification. Some specimens were mounted in corn syrup without the stain. Herbarium sheets are filed in either the NU or SAM collections and the slides and formalin-preserved specimens are maintained in the laboratory at the Compton Herbarium. Numbers referred to in the *Nat* collections are from the Natal Benthic Macroalgal project.

Results and Discussion

1. ***Asparagopsis*** Montagne (1840)
(Rhodophyceae Bonnemaisoniaceae). Figures 1 – 6.

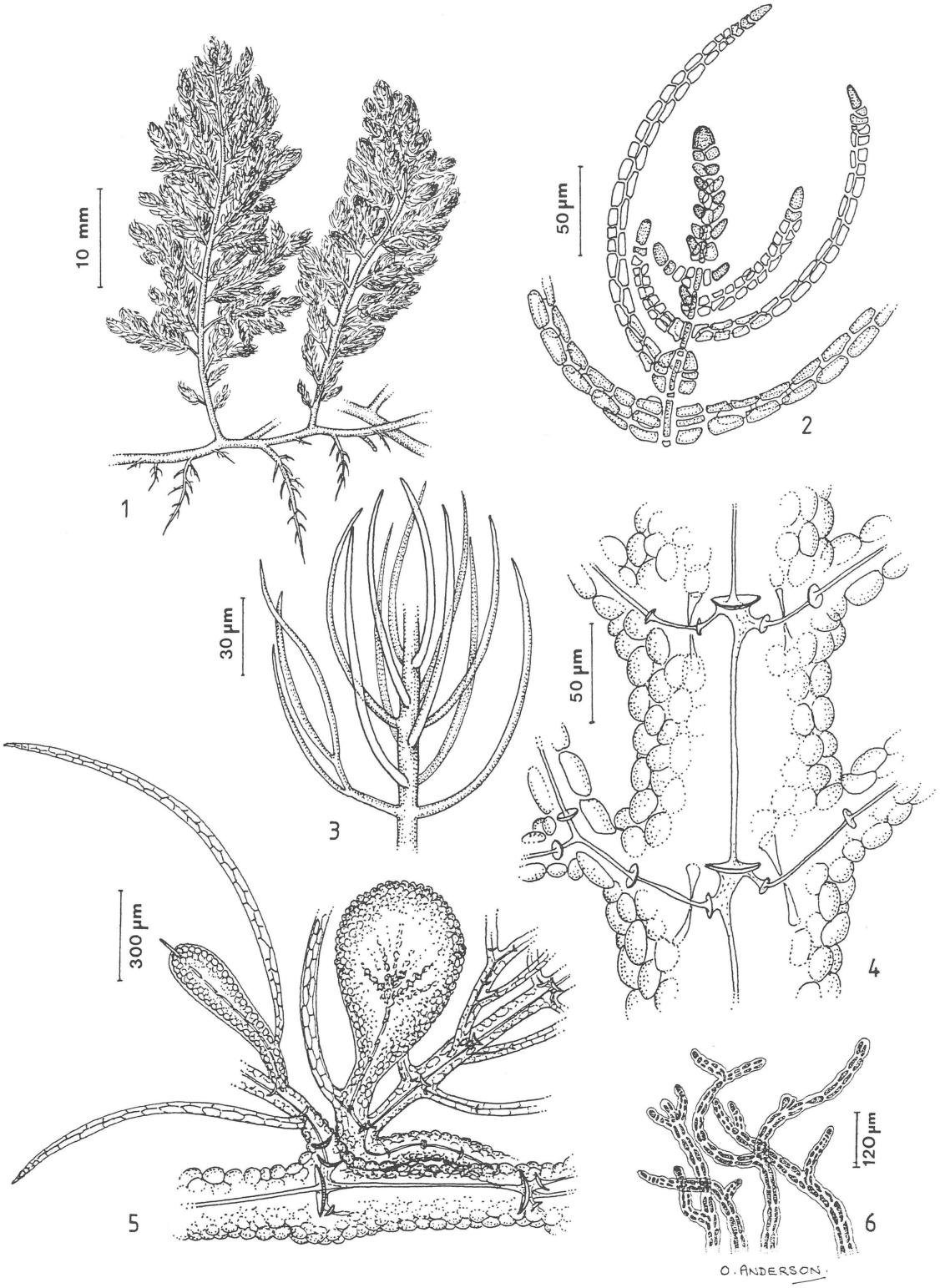
Listed by Seagrief (1984) as an italicized entry, indicating synonymy or an uncertain entry, *Asparagopsis* is the gametophyte of *Falkenbergia*, a genus that was authentically entered in his list. This confusing record may be because of the common occurrence of the tetrasporophyte on South Africa's east and south coasts, although rarely fertile in Natal, and Seagrief's anticipation that gametophytes are in this region. I recorded three Natal collections of gametophytes of *A. taxiformis* (Delile) Trevisan (1845) (Figures 1 – 5), a species often considered to be different from *A. armata*, the one mentioned by Seagrief: Nat 2057 – NU 09412 – NU 9412, Reef at Reunion Rocks [2930 (Pietermaritzburg); (–DD)] 29°59′S; 30°58′E, 16-IV-1984, *legit* R.E. Norris; Nat 4372 – SAM 103280, NU 09914, Reef at mouth of Kosi Bay [2632 (Bela Vista); (–DD)] 26°53′S; 32°53′E, 18-XI-1986, *legit* J. Phelan; Nat 5953 – SAM 101383, Hully Point [2732 (Ubombo); (–DA)] 27°20′S; 32°45′E, 14-II-1989, *legit* R. Broker. It is not surprising to find *A. taxiformis* in Natal, it being a pantropical species that is known to occur in Mauritius (Børgesen 1942, 1951) in the western Indian Ocean, although it was not recorded in Tanzania by Jaasund (1976). The tetrasporophyte phase of *A. taxiformis* was reported to be *Falkenbergia hillebrandii* Falkenberg, a 'species' different from the one, *F. rufolanosa* (Harvey) Schmitz, reported from South Africa by Seagrief (1984). Further research, using cultures, is needed to identify the tetrasporophytes in Natal (Figure 6). The specimens in our collections are infertile.

The gametophytes in our collections are without spines, the only structural difference between *A. armata* and *A. taxiformis*, and, as was mentioned by Lawson and John (1987), the two species may not be distinct.

2. *Dudresnaya* Bonnemaison (1822) (Rhodophyceae Dumontiaceae). Figures 7 – 10.

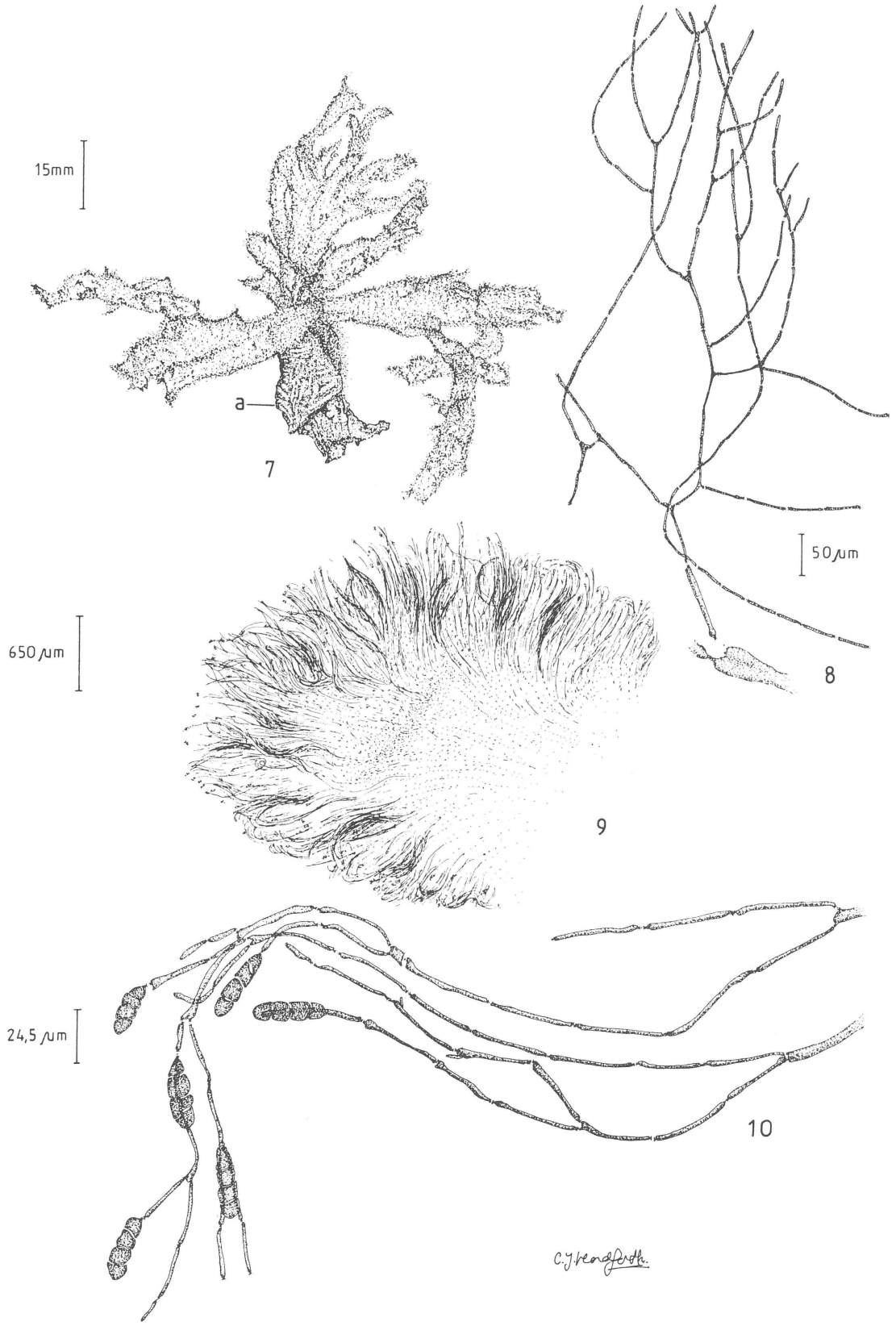
Although this genus has a pantropical distribution, there is no previous east African record for it, so far as I could determine. It is known from tropical west Africa (Price *et al.* 1986), records that require verification according to Lawson and John (1987). In the Indian Ocean, *Dudresnaya* is recorded only from western Australia (Robins & Kraft 1985).

The discovery of a specimen belonging to this genus from deep water in Natal (Figures 7 – 10) provides a record for the genus from the western Indian Ocean. The Natal speci-



Figures 1 – 6 *Asparagopsis taxiformis* (Nat 4372, SAM 103280, NU 9914). 1. Habit of a gametophyte. 2. Tip of growing axis. 3. Enlarged branch showing branchlet arrangement. 4. Optical section through axis showing branching of axial filament and cortex. 5. Two young cystocarps, the larger one emerging from a branch lying behind the larger axis. 6. Part of a sterile tetrasporophyte, the *Falkenbergia* stage.

men is a tetrasporophyte (Figure 10), and, using the vegetative characters listed by Robins and Kraft (1985), it can be classified as *D. hawaiiensis* R.K.S. Lee (1963). The only other species with which it can be confused is *D. capricornica* Robins et Kraft, but the lack of a single determinate axis, consistently small rhizoids and absence of crystalline cell inclusions indicate that the Natal specimen is *D. hawaiiensis*. This is the first tetrasporophyte reported for this species and thereby confirms an alternation of isomorphic phases in its life history. Specimen examined: Nat 5870,



Figures 7 - 10 *Dudresnaya* cf. *hawaiiensis* (Nat 5870, SAM 103302). 7. Habit of plant growing on an echinoid animal (a). 8. Some vegetative filaments enlarged from Figure 9. 9. Enlargement of branch tip of Figure 7. 10. Filaments terminating in zonately divided tetrasporangia.

SAM 103302, by diving to 23 m, *legit* R. Broker, at 5-mile reef, Sordwana Bay, Natal [2732 (Ubombo); (–DA), 27° 32′S; 32°40′E].

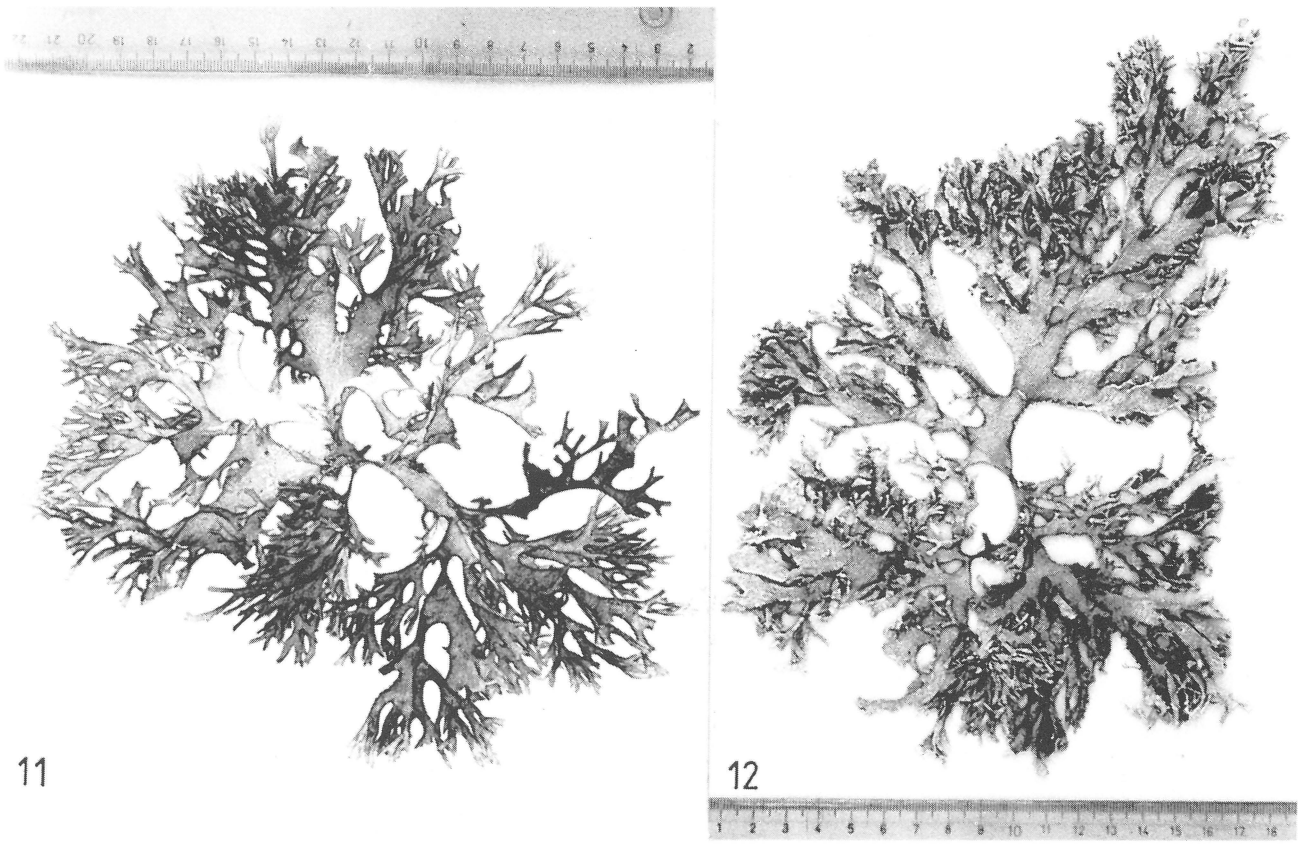
3. *Titanophora* (J. Agardh) Feldmann (1942) (Rhodophyceae, Gymnophlaeaceae). Figures 11 – 19.

Titanophora is a lightly calcified plant having a foliose form with a characteristic soft and pliable texture. The genus has been studied most recently by Mshigeni and Papenfuss (1980), but gaps remain in our knowledge of its structure and reproduction.

Plants of *Titanophora* were found in northern Natal, the first records of this genus south of northern Madagascar, which provided the opportunity to search for new information on structure and reproduction. The plants in our collections, two of which are shown in Figures 11 and 12, vary from 30 to 180 mm tall and have terminal branches measuring from 1 to 3 mm broad. Widest parts of branches are up to 25 mm broad. The thalli are irregularly branched, often subdichotomous and flabellate. Proliferous outgrowths of varying dimensions and shapes occur on margins of some branches (Figure 12), but other thalli may have few or no outgrowths (Figure 11).

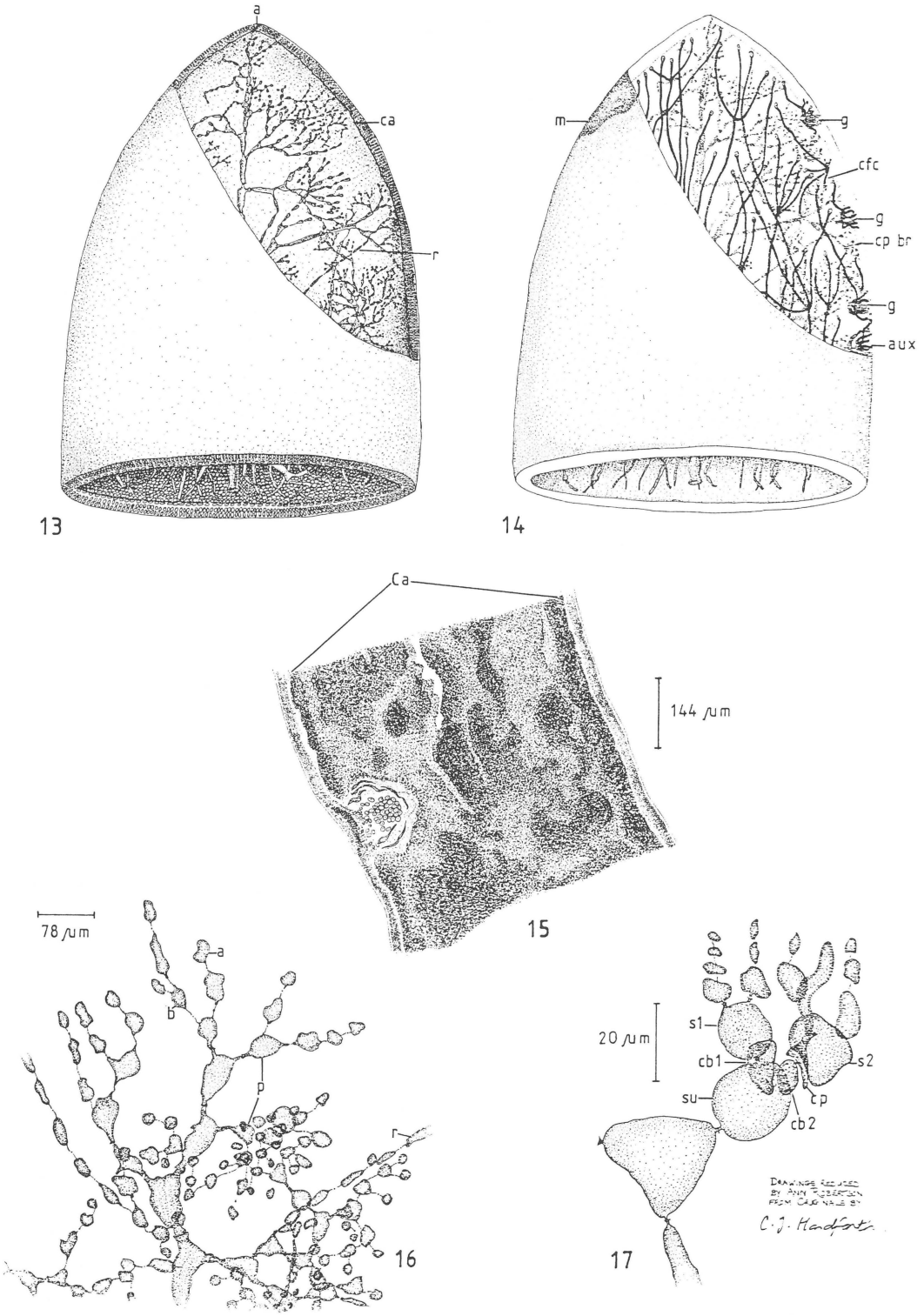
The anatomy of the thalli is similar to that described by Mshigeni and Papenfuss (1980), although my interpretations of tissue development differs from theirs. The cortex and reproductive structures, including cystocarps, are in an uncalcified surface layer (Figures 13 – 15), and calcium carbonate crystals occur within the mucilaginous wall material between cells of the medulla. The 'ordinary medullary cells', as described by Mshigeni and Papenfuss, comprise filaments that branch less often than the 'large central medullary cells' in their description. Mshigeni and Papenfuss attributed the derivation of cortical cells to the terminating cells of the 'ordinary medullary filaments', but I found that these filaments remain within the medulla and usually terminate there.

The cortex is formed by ternminating parts of the 'large central cells' (Mshigeni & Papenfuss 1980) of the medulla, and it was discovered that this filamentous system represents part of an outstanding structural character of the *Titanophora* thallus that has not been previously noted, namely the presence of a large-celled axial filament (Figures 13 and 16). The axial filament is present in all the thalli that I have examined, often being lateral in the flattened or compressed thallus, a displaced position probably caused by bubbles produced in the decalcification proccess. This filament and its periaxial filaments, which are primary tissue, comprise the 'large central cells' of the medulla described by Mshigeni and Papenfuss (1980). Each cell of the axial filament produces a single periaxial filament of progressively smaller cells that terminates in the cortex. Periaxial filaments are cut off on all sides of the axial filament which is visible throughout the thallus, except in distal regions where a distinct enlarged apical cell does not exist. The apical cell (Figure 16) is small but can be identified by its position terminating the axial filament. Two actively dividing apices can sometimes be identified and it is difficult to know whether one was more active than the other, but it is possi-



Figures 11 - 12 *Titanophora pikeana*. Two gametophyte specimens from Natal. 11. A relatively thin and non-proliferous thallus presumed to be at an early stage of maturity (Nat 5921, SAM 101063). 12. A more mature thallus that has developed many proliferations on the margins (Nat 5951, SAM 101062).

ble that fasciated apices may sometimes be present. Cells of axial and inner periaxial filaments produce one to several mostly proximally directed rhizoidal filaments comprised of elongated narrow cells. These secondary filaments (the 'ordinary medullary cells' of Mshigeni and Papenfuss) multiply profusely and form the bulk of the medullary tissue



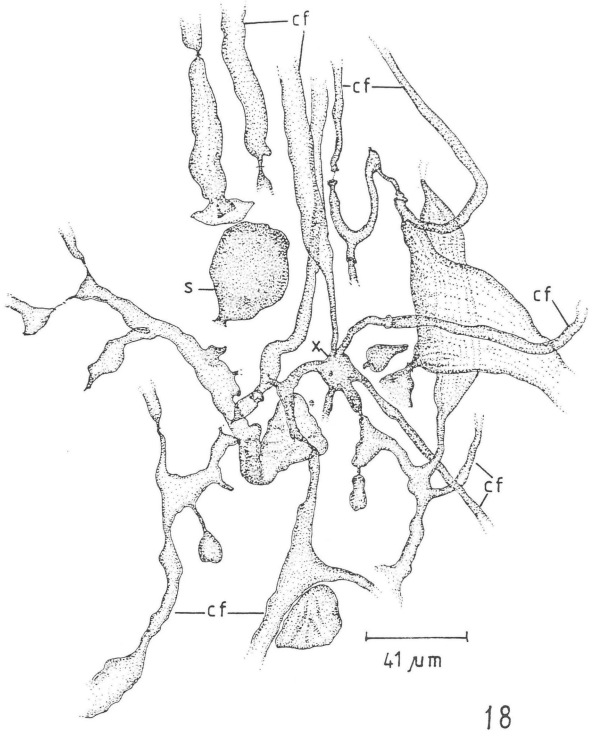
Figures 13 - 17 *Titanophora pikeana*, anatomy and reproduction. 13. Diagram of branch tip with part of cortex removed to show vegetative tissues, particularly the axial filament and apical cell (a), periaxial filaments (p) and some of their branches, and a few secondarily developed medullary filaments (r). Note the boundary of calcification confined to the inside of the line indicated at Ca. 14. Diagram of the same branch tip, cortical cells not shown, to illustrate how addition of some reproductive tissue changes the appearance of the anatomy (aux, an undiploidized auxiliary cell; cp br, carpogonial branch system; cfc, a connecting filament centre, presumably the site of a fertilized carpogonium; g, young gonimoblasts surrounded by involucral filaments; m, part of a male sorus). 15. Section of a thallus before decalcification to show that the calcium carbonate crystals are within the medulla, the area indicated by Ca, the cortex remaining uncalcified. Note that a cystocarp is present and is part of the uncalcified part of the thallus. 16. Axial filament at branch tip showing the apical cell (a), periaxial cells (p), and a secondarily developed medullary filament (r). 17. Carpogonial branch apparatus, presumably before fertilization (cb1, 1st carpogonial branch cell; cb2, 2nd carpogonial branch cell; cp, carpogonium with a trichogyne; s1, s2, sterile cells attached to the supporting cell, su).

in adult parts of thalli. Some of the primary tissue in a branch tip as well as a few secondarily developed medullary filaments (r in Figures 13 and 16) are diagrammatically illustrated in Figure 13.

Gland cells are large ovoid or spheroid, or cells with other shapes, occurring in intercalary positions or terminally in the inner cortex. Some terminal gland cells occur adjacent to outer cortical cells. Intercalary gland cells [the same as the refractive medullary cells of Mshigeni and Papenfuss (1980)] may be found in the medulla. These cells become elongate cylindrical or dumbbell-shaped in such positions and sometimes produce small protuberant lobes. Cortical gland cells may also be slightly elongate. Gland cells often occur in pairs. Contents of gland cells vary from the globular material described by Mshigeni and Papenfuss (1980) to densely arranged fine granules. Gland cells with globules or granules stain darkly with aniline blue, but some gland cells, identified by their larger size, contain sparse granules and stain no more darkly than adjacent cortical cells. Gland cells in some of the Natal specimens are distributed in small groups rather than being more or less equally dispersed in the thallus. In regions where gland cells are highly concentrated they are smaller than in regions where they are less dense. Large areas in such thalli may have no gland cells and it would be possible to make sections in these regions and have the impression that gland cells are missing from the thalli.

All thalli that I have observed are monoecious gametophytes, and tetrasporophytes have not been previously reported for this genus. Carpogonial branch systems (Figure 17) of the Natalian specimens are the same as those described by Mshigeni and Papenfuss (1980). Immediate post-fertilization stages were rarely found and information on these stages remain unclear. Connecting filaments, however, emerge from the region of the carpogonial branch (Figure 18), probably after fusion of the carpogonium with adjacent cells. Connecting filaments are non-septate, often fusing with vegetative cells in the thallus at which points they may form septa and branches.

After diploidization, a continuing connecting filament is formed as a protuberance on the auxiliary cell that is cut off by a cell wall (Figure 19). Connecting filaments have been followed through several successive auxiliary cells, confirming that growth of connecting filaments is indeterminate. Indeed, I have noted that undiploidized auxiliary cells in my specimens of *Titanophora* are extremely rare. One can usually find several connecting filament apices in tips of thallus branches, these filaments apparently growing mostly in a distal direction and probably diploidizing new auxiliary cells as they mature and become receptive. Although carpogonial branch systems are not difficult to find in *Titanophora* thalli, most of them that I have seen are past their functional stage and are invaded by vegetative filaments, indicating their senescence. It can be assumed, therefore, because of the progressive activity of connecting filaments and their presumed ability to acquire nutrient for growth by attaching to vegetative cells, that most diploidizations in *Titanophora* occur as a result of very few fertilizations. This assumption is supported by the scarcity of fertilized carpogonial branch systems that have been found, and it is even possible to hypothesize that a single fertilized carpogonium could furnish connecting filaments that diploidize most, if



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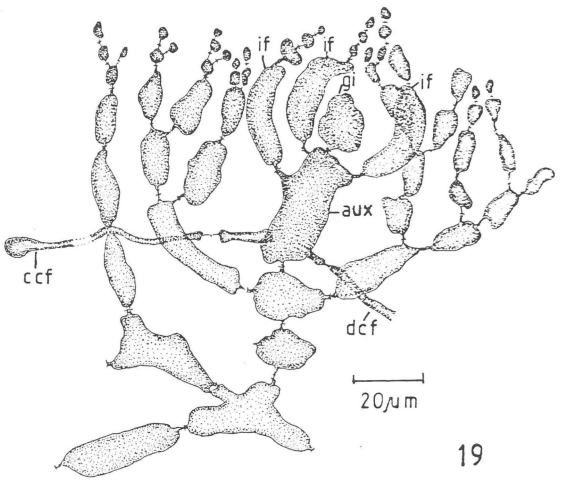

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DRAWINGS REDUCED BY ANN ROBERTSON FROM ORIGINALS BY C. J. Hardforth

Figures 18, 19 *Titanophora pikeana*, anatomy and reproduction (*continued*). 18. Centre where connecting filaments (cf) presumably originated after fertilization. A sterile cell (s) is present but broken free from attachment. The branching of connecting filaments (x) may repregent their source from the fertilized carpogonium. The broad regions of connecting filaments probably are areas where they attached to vegetative filaments. 19. Auxiliary cell (aux) system shortly after diploidization (ccf, an ongoing connecting filament that continues diploidization of other auxiliary cells; dcf, the connecting filament that diploidized this auxiliary cell; gi, gonimoblast initial; if, cells of the involucral filaments).

not all, auxiliary cells formed in the thallus. Connecting filaments, identified by the absence of septa except where they fuse with other cells, are abundant in mature female plants. They are inconspicuous because of their thin and lightly stained protoplast, except at their tips, and the unstained thin walls. They grow mostly toward branch tips and apparently diploidize auxiliary cells soon after they have developed. It seems possible that connecting filaments, from a few fertilization sources, can grow and diploidize indefinitely in thalli.

Connecting filaments have been observed to be fused with auxiliary cells in stages where well-developed gonimoblasts have been produced (Weber-van Bosse 1921; Børgesen 1943; this investigation). The identity of the auxiliary cell system before diploidization occurs, or in very early stages of gonimoblast development, has not been previously documented. Okamura (1916) illustrated what he believed to be an undiploidized auxiliary cell, but, because a pore is present in the cavity above it, I believe that this is in a more advanced stage of gonimoblast formation. The undiploidized auxiliary cell has been commonly found in the Natal specimens and it is formed by the primary branching system, its branch being traceable to the axial filament. The undiploidized auxiliary cell system consists of an enlarged inner cortical cell, the auxiliary cell, from which emerge several branches having cells decreasing in size towards the thallus surface (Figure 19). The cells of this apparatus are distinguishable from other cortical branches by the larger size and curved shape of the basal cells of each branch and the more condensed nature of the branchlets. These branchlets also have a few more cells that are closer together than similar vegetative branchlets in the cortex, and the outer cells in the auxiliary cell apparatus are slightly smaller. The cells enlarge as the auxiliary cell apparatus matures and becomes spread apart in the cortex, the basal involucral cells sometimes being irregularly branched. These branchlets that are attached to the auxiliary cell, and a subtending similar system of branches, surround the gonimoblast as it develops, forming a relatively loose involucre.

The mature auxiliary cell is diploidized by the tip of a connecting filament. A new, continuing connecting filament is formed, usually on the side of the auxiliary cell opposite to the point of fusion with the connecting filament (Figure 19). The diploidized auxiliary cell divides to form a large cell on the side towards the thallus surface and this cell serves as the generative cell for the gonimoblast (Figure 19). With the exception of this generative cell and an occational other sterile cell attached to it, the entire gonimoblast becomes converted to carposporangia. Carposporangia develop in groups from different sides of the generative cell, each group being at a slightly different stage of development. The carposporophyte, therefore, is comprised of several groups of carposporangia, each at a different stage of maturation. The mature carposporophyte is surrounded by a loose mass of involucral filaments derived from filaments attached to the auxiliary cell and its bearing cell. A pore forms through the outer cortex as the gonimoblast develops. The carposporophyte at this stage has been illustrated by Børgesen (1943, 1949). In the specimens observed, the entire gonimoblast and its involucral filaments occur within the uncalcified outer cortical region of the thallus.

Species of *Titanophora* have been determined primarily on habit of the plant, dimensions of the thallus and its branches, form of the branches, as well as position and size of protuberances and proliferations. In addition, absence of gland cells segregates two species (*T. pulchra* Dawson 1954 and *T. marianensis* Itono et Tsuda 1980), gland cells having been reported in all the other species.

The range of form of thalli in the Natal collections is variable. All thalli have an irregularly pseudodichotomous branching pattern. Some plants are highly proliferous from the margins, but others have no proliferations. Some small plants are comprised mostly of narrow cylindrical branches, flattening of branches occurring only in the more proximal areas. Characters that are used to separate species of *Titanophora*, mainly external form of the thallus and presence or absence of gland cells, are so variable that most of them cannot be considered to be reliable. It seems likely that there is a single variable species in this genus, and the Natal entity is identified as *T. pikeana* (Dickie) J. Agardh, the type species of the genus.

Titanophora is widely distributed in tropical and subtropical regions of the Indo-Pacific and the Caribbean as is evident from Table 1 of Mshigeni and Papenfuss (1980). Specimens in Natal were found in four collections in the far north. All but one specimen are from drift collections on the beach in northern Natal. Nat 3796, Black Rock [2732 Ubombo; (–BB)] (27°08′S, 32°49′E), 19-I-1986, *legit* A.J. Phelan; Nat 5839, Lala Nek [2732 (Ubombo); (–BB)], 27°13′S; 32°47′E, 6-XII-1987, *legit*. A.J. Phelan, Nat 5921, diving to 21 m at 4-mile reef, Sordwana Bay [2732 (Ubombo); (–DA)] 27°32′S; 32°40′E, 5-II-1989, *legit* R. Broker; (Nat 5951), Hully Pt. [2732 (Ubombo); (–DA)] 27°20′S; 32°45′E, 14-II-1989, *legit* R. Broker.

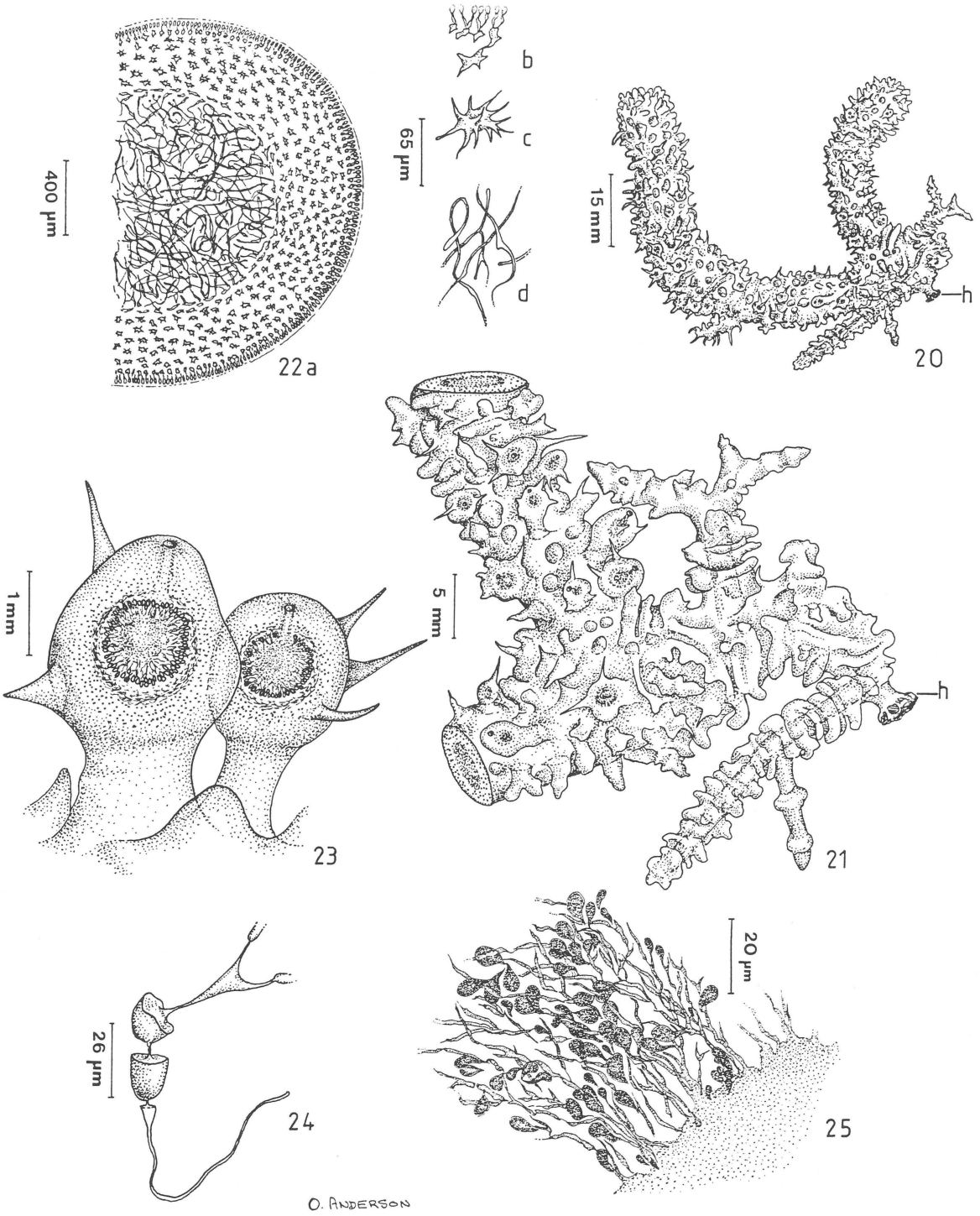
4. *Eucheuma* J. Agardh (1847)
(Rhodophyceae, Solieriaceae). Figures 20 – 28.

Although included in Seagrief's list (1984), the records for *Eucheuma* in South Africa are without authentication (Papenfuss 1943), and Doty (1988, p.180) states that 'there seem to be no specimens or recent reports of finding any *Eucheuma* anywhere in South Africa'.

It is unusual that this genus, often relatively common in tropical and subtropical seas, was not previously found in at least northern Natal, especially because it occurs farther north along the African east coast (Mshigeni 1984, Doty 1988). Our collections in Natal have produced two specimens of *Eucheuma*-like species, one specimen having been found in drift material, probably from an off-shore reef in northern Natal {Nat 5609, SAM 103239, Lala Nek [2732 (Ubombo); (–BE)] 27°13′S; 32°47′E, 11-XII-1985, *legit* J. Phelan}, and the other specimen found by M.E. Aken and S.R. Meyer in an intertidal pool on a reef at Cape Vidal {Nat 5840, SAM 101011 [2832 (Mtubatuba): (–BB)] 28°08′S; 32°34′E, 26-IX-1984}. The two specimens represent two different species, the Lala Nek thallus (Figures 20 and 21) being much thicker and covered by spines, whereas the narrower Cape Vidal thallus (Figures 26 and 27) has fewer spines and constrictions in the thallus. Species of *Eucheuma* are not well-defined (Doty 1988) and without a large number of specimens in which structural variations can be compared, identification of the Natalian specimens

can only be estimated. The Lala Nek specimen from the drift collection is cystocarpic, the pericarp often ornamented with several spines (Figure 23). Doty (1988) assigned all such species to the section Gelatiformia Doty et Norris (1985), and the Natal specimen has characters that ally it with *E. odontophorum* Børgesen (1943), a species occurring in the western Indian Ocean.

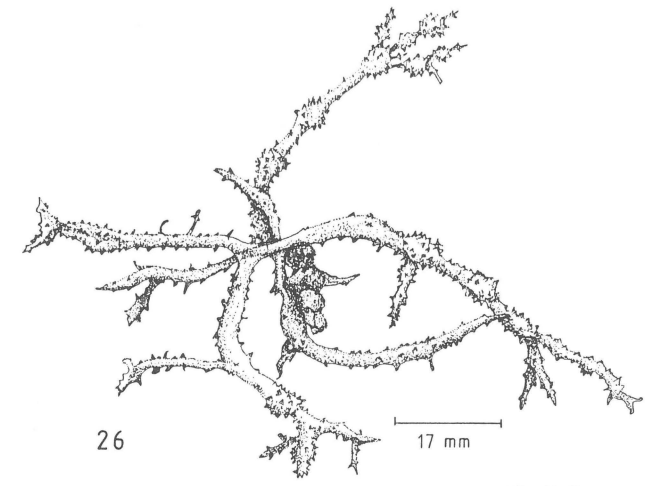
Cheney (in Gabrielson & Cheney 1987) separated three Atlantic Ocean species of *Eucheuma* into a new genus, *Meristiella*. Among other characters listed as different for the new genus, separating it from *Eucheuma*, are spines occurring on the pericarp and a cellular core in the cystocarp, consisting of vegetative and gonimoblast filaments, rather than a large fusion cell as in *Eucheuma*. The Natal specimen tentatively assigned to *E. odontophorum* has a large fusion cell in the centre of the cystocarp (Figures 23 and 25), and spines are present on the pericarp (Figures 21 and 23), important anomalies to the generic descriptions of

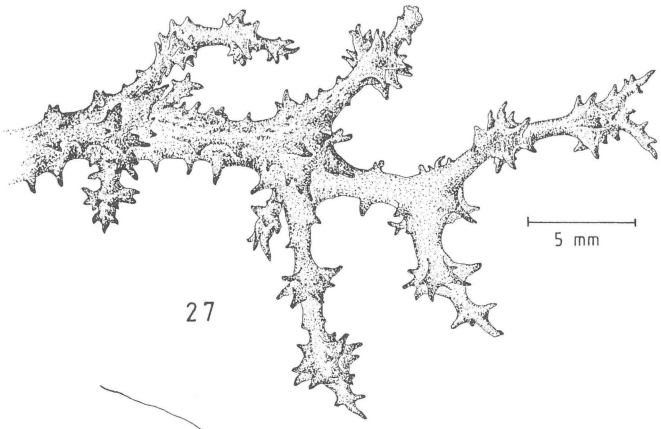


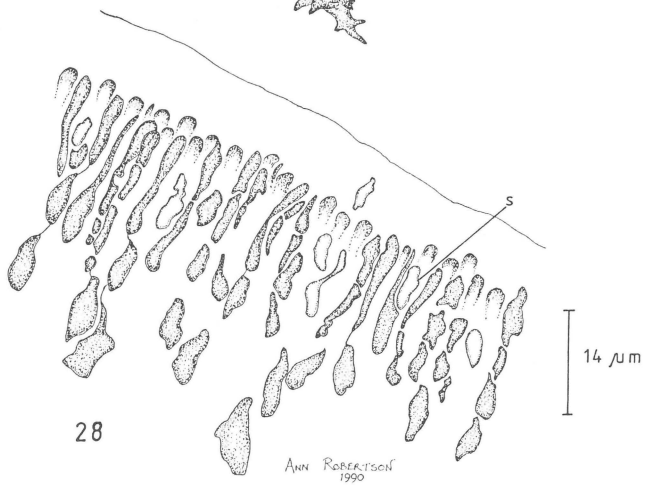
Figures 20 - 25 *Eucheuma* cf. *odontophorum*, a cystocarpic plant (Nat 5609, SAM 103239). 20. Habit of plant. Note holdfast (h). 21. Enlargement of base of plant in Figure 20. 22. (a) Cross-section of thallus; (b) outer cortical cells; (c) inner cortical cells; (d) medullary cells forming filaments. 23. Two cystocarps on branchlets from thallus surface. Note several spines often present on cystocarps. Fusion cell and gonimoblast are in optical section. 24. Carpogonial branch. 25. Optical section of part of the large central fusion cell in a cystocarp with attached gonimoblast filaments producing carposporangia.

Gabrielson and Cheney (1987).

The Cape Vidal specimen (Figures 26 and 27) is male. It is fertile mostly in tips of branches where the outer cortical cells become greatly elongate and cut off a smaller cell laterally (Figure 28). This lateral cell is the spermatangial mother cell which forms an oblique division separating off a single spermatangium that is released through the outer mucilage. Groups of inner cortical cells with a larger plump form are present in fertile regions, probably supplying nutrients for active divisions occurring in the fertile area. Regions of active spermatium generation do not always occur above the groups of presumed nutritive cells. The form of the Cape Vidal specimen is similar to *E. denticulatum* (N.L. Burman) Collins et Hervey (1917) as the species is defined by Doty (1988), an extremely variable species that is known to occur north of Natal in Mozambique.







Figures 26 - 28 *Eucheuma* cf. *denticulatum*, a male plant (Nat 5840, SAM 101011). 26. Habit of plant. 27. Enlargement of branch to show surface texture. 28. Section through cortex of fertile region (s, spermatangium).

5. *Boergesenia forbesii* (Harvey) J. Feldmann (1938) (Ulvophyceae, Siphonocladaceae, following the system proposed by van den Hoek *et al.* 1988).

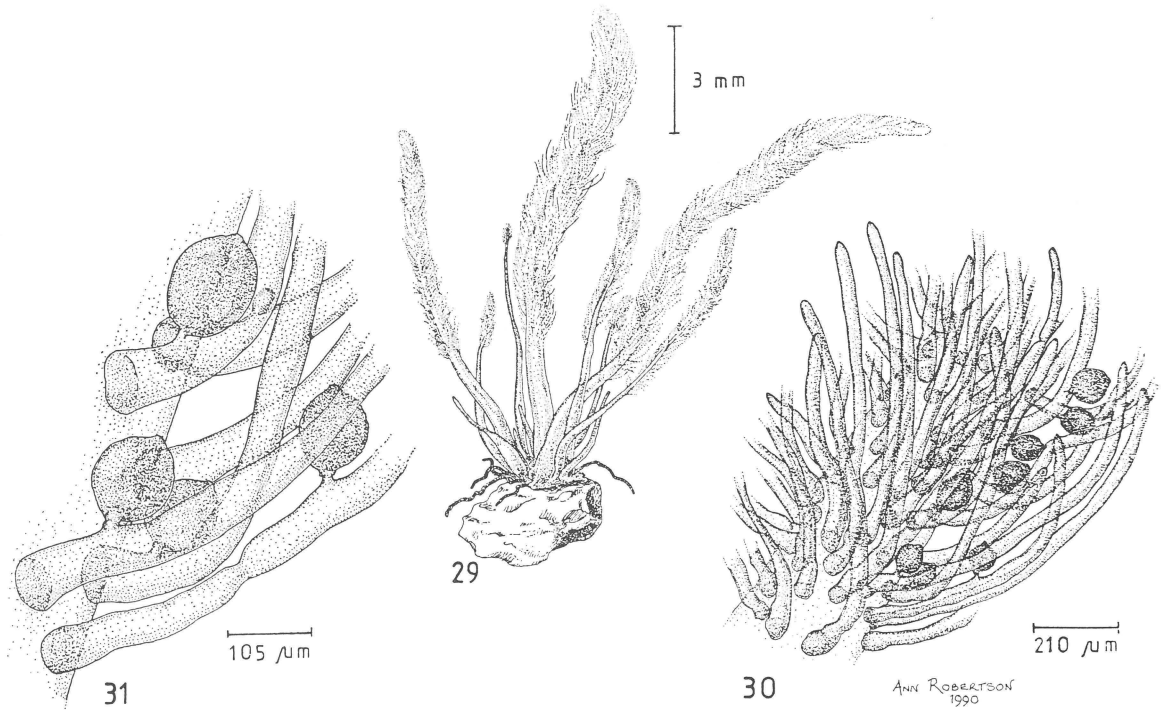
This species is recorded from Tanzania (Jaasund 1976) but has not been found in Mozambique nor in Natal, so far as I can determine. A small specimen consisting of a branched rhizoid subtending a small cluster of vesicles, all a continuous coenocyte, was found at Lala Nek [2732 (Ubombo); (–BB)] 27°13′S; 32°47′E, *legit* J. Phelan (Nat 3800, slide No. 4860), 9-III-1986. A reticulate protoplasm was peripheral in the vesicles in which were embedded spindle-shaped chloroplasts, each containing a single pyrenoid.

Because Natal undoubtedly represents the southern limits in the east African range of this species, the plants of *Boergesenia forbesii* may never become large enough to be conspicuous in the flora of this region. The fragile nature of the very large cells, that often collapse into somewhat unrecognizable forms, probably also contributes to the absence of previous records for this species in this region.

6. *Trichosolen* Montagne (1860) (Ulvophyceae, Bryopsidaceae). Figures 29 – 31.

Known from many tropical and subtropical parts of the world, *Trichosolen*, which often is listed as *Pseudobryopsis* Berthold in Oltmanns, is known in the western Indian Ocean only off the African coast in Madagascar (Farghaly 1980) and Mauritius (Børgesen 1948).

Two collections of *Trichosolen* were made from northern Natal, one in the intertidal at the reef near the mouth of Kosi Bay [2632 (Bela Vista); (–DD)] 26°53′S; 32°53′E, Nat 0543, SAM 103254) 16-XI-1982, *legit* S.R. Meyer, B.P. Emanuel & K. Balkwill, and the other at Cape Vidal [2832 (Mtubatuba); (–BB)] 28°08′S; 32°34′E (Nat 5213, SAM 103268) 26-IX-1984, *legit* M. Brouwer. Both collections contain the same species, the plants being comparatively small (Figure 29), having a rhizoidal base from which a cluster of upright plumose branches emerges. The upright branches have a maximum height of 30 mm, each having an unbranched axis surrounded on all sides by branchlets covering all but the proximal part of the axis. The tufts are up to 2.5 mm broad, the axis being approximately 500 – 600 µm broad and the pinnae measuring approximately 1.5 to 1.7 mm long and 50 – 60 µm in diameter. All pinnae that were observed were unbranched, and single gametangia were borne adaxially and proximally on the pinnae (Figures 30 and 31). Gametangia are ellipsoidal, the largest measuring approximately 100 × 150 µm and having an apical papilla. Chloroplasts are discoid, 2 – 3 µm in diameter and with transparent body that sometimes is designated a pyrenoid [see the discussion on this point by Kobara and Chihara (1978)]. Although the pinnae and gametangia of the Natal specimens are somewhat larger than those of typical specimens of *T. hainanensis* (Tseng) W.R. Taylor (1962), this name is given to these plants until further research may prove that their structure, reproductive organs



Figures 29 - 31 *Trichosolen hainanensis*. 29. Habit of plant. 30, 31. Enlargements of fertile region.

or life history have characters different from this species. The gametangia in the Natal specimens are mostly borne singly on pinnae rather than several as in the Japanese plants (Kobara & Chihara 1978). *Trichosolen hainanensis* is known to occur in southern Japan as well as along the coast of China, but this is the first record of plants similar to this species in the Indian Ocean.

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